Abhisek Praharaj

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Education

- **Indian Institute of Science Education and Research (IISER-BPR)**, Berhampur, Odisha, India
  - **BS-MS (Dual Degree) - Physics Major; CPI: 8.5** (July 2019 - July 2024)
    - **Courses:** Classical Mechanics, Quantum Mechanics, Advanced Quantum Mechanics, Mathematical Physics, Introduction to Statistics, Thermal Physics, Data Science, Machine Learning and Deep Learning, Electrodynamics, Condensed Matter Physics, Introduction to Semiconductor Physics, Astrophysics, Atomic and Nuclear Physics, Physics of the strongly interacting matter produced in relativistic heavy ion collisions, Numerical Methods and Programming.
    - The Bachelor of Science program started from July 2019 to July 2022 [6 semesters], and now the master's program is going on from July 2022 to July 2024 [4 semesters].
- **Saraswati Sishu Vidya Mandir, Neelakantha Nagar, Berhampur**, Berhampur, Odisha, India
  - **Class 12th [Higher Secondary Education]; Percentage Obtained: 79** (August 2016 - August 2018)
  - The one-year gap after higher secondary education is for the preparation for different entrance exams.
- **Saraswati Sishu Vidya Mandir, Khurda**, Khurda, Odisha, India
  - **Class 10th Board Examination; Percentage Obtained: 92.5** (August 2008 - August 2016)

Bio

I am a graduate who completed a 5-year BS-MS program at the Indian Institute of Science Education and Research, Berhampur. I have a keen interest in atomic and nuclear physics, machine learning, deep learning, computational physics and neuroscience. I possess strong analytical and computational skills, with experience working in a research environment. Currently, I am working on different aspects of computational physics.

Skills Summary

- **Computer Languages**: Python, C++, ROOT(Cern), Matlab
- **Platforms**: Linux, Windows, Arduino
- **Soft Skills**: Writing,Time Management
- **Natural Languages**: English, Hindi, Sanskrit, Odia

Experience

- **Master's Thesis at Indian Institute of Science Education and Research, Berhampur** (offline)
  - **Dissertation** (June 2023 - July 2024)
    - Measurement of Charged K* in Au - Au collision at RHIC Beam Energy Scan
      - Under the Supervision of Dr. Md. Nasim, I have successfully completed my master's thesis in the field of heavy-ion collision. I encompassed the mass, width, and invariant yields of the $K^{*\pm}$ meson, decay channel $(K^{*\pm} \rightarrow K^0_S + \pi^{\pm})$ at $\sqrt{s_{NN}} = 19.6$ GeV and 14.5 GeV. Additionally, we present the average transverse momentum $\langle p_T \rangle$ of $K^{*\pm}$ and compare it with other hadrons in the rapidity window of $(-0.5 < y < 0.5)$. Furthermore, we illustrate the resonance-to-non-resonance ratio as a function of centrality to investigate the effects of rescattering and regeneration.
- **Summer Research Intern at Indian Institute of Physics (IOPB), Bhubaneswar, Odisha, India** (offline and remote)
  - **Student-Intern** (May 2022 - Jan 2023)
    - Particle detection and Implementation of the different algorithms in the field of High Energy Physics using deep learning and artificial neural networks.
      - Under the supervision of Dr. Aruna Kumar Nayak and the direction of Sanu Varghese, I successfully finished my internship in differentiating signals and backgrounds utilizing deep learning and artificial neural networks. To distinguish between background and signal data, I worked mostly on the particle collision dataset (synthetic data), which was produced using Monte Carlo simulation tools. I experimented with the data set with several models like Convolution Neural Network(CNN) 1D and 2D, Dense Neural Network(DNN) with different layers to check the efficiency of models.
- **Summer Research Intern at Indian Institute of Technology, Indore (IIT INDORE)** (Remote)
  - **Student Intern** (June 2021 - July 2021)
    - "Space weather prediction using Machine Learning and A.I." under Dr. Saurabh Das. (With certification)
      - In this internship program, I have studied the sun, solar flares, Coronal Mass Emission, solar winds, airglow and aurora and used some data sets from the satellites, which consisted of pictures of the sun in different wavelengths and some time-lapse of it, which was further refined using machine learning and Python coding to know about the coronary mass emission (CME), solar flare and high energy pulse emission. Then, predict the space weather using this data.

Projects

- **Analysis Data - (High Energy Physics)**: In this repository, I've meticulously detailed the analysis techniques used in Heavy-Ion Collision, focusing on Au-Au collisions at 200 GeV. I've explored kaon spectra and extracted Phi meson Invariant Yield within a specific centrality range.
  Project link: GITHUB LINK.
- **Projects on Numerical Methods**: In this repository, various numerical methods are used to solve some real-world problems in a very sophisticated and graphical way. This repository contains some of the numerical methods which are used to solve some substantial problems.
  Project link: GITHUB LINK.
- **Deep Learning applications on Particle Physics (HEP) - (Keras, PyTorch, Machine Learning, Deep Learning, Python)**: (Work in progress) In this project, I evaluated multiple deep learning models on a Monte-Carlo simulation of particle physics data-set to determine how efficient they are at detecting distinct particles.
  Project link: GITHUB LINK.
- **RootBasics (HEP) - (C++, ROOT-CERN, High Energy Physics)**: (Work in progress) This project will teach you the basics of ROOT. I have utilized the C++ programming language and the ROOT framework to work on some basic ideas in this project. These ideas include drawing simple histograms and graphs with and without error bars, defining trees, adding trees to a root file, and reading the contents of a root file. Reading through this project, one may learn the fundamentals of working with root files and creating a histogram and graph from data files.
  Project link: GITHUB LINK.

Workshops and Courses

- **29 june 2024**: Completed a introductory course on machine learning and deep learning offered by Stanford University in coursera platform .
- **29 October 2022**: Completed two courses on machine learning and deep learning offered by Kaggle.
- **21 November 2021**: Attended IASC (International Astronomical Search Collaboration) organized by NASA.
- **3 April 2021**: Participated in a workshop on Data and Cosmology at IIT Madras during "Research Scholar Day 2021" and used satellite data to understand the cosmos.
- **15 January 2021**: Participated in a workshop on satellites and Geo-sensing by IIRS and ISRO.
- **6 February 2020**: Demonstrated the relationship between high voltage electricity, plasma, and fire to high school students at IISER Berhampur, Odisha.
- **15 January 2020**: Participated in a robotics program and gained hands-on experience with the Arduino-UNO board at IISER Berhampur, Odisha.
- **5 January 2020**: Attended a workshop on Radio Astronomy and Hubble Data Processing at IISER Berhampur.
- **August 2020 - September 2020**: Completed an online course "From the Big Bang to Dark Energy" by Prof. Hitoshi Murayama at the University of Tokyo, Japan.
- **May 2020 - August 2020**: Completed a basic track on A.I. at the University of Helsinki, Finland.
- **February 2019 - May 2020**: Completed a course on nuclear engineering at National Research Nuclear University ME Phi (Moscow Engineering Physics Institute).

Articles and Publications

- **An introduction to electromagnetic shielding and shielding cables**
  Link: Article Link.
- **An introduction to squeezed states in quantum mechanics**
  Link: Presentation Link.
- **A brief introduction to dark matter and dark energy**
  Link: Article Link.

Honours and Awards

- **Pathani Samantha Mathematics Scholarship award** - September 2016
- **Awarded for acquiring highest mark in class 10th** - August 2016
- **Awarded National Rural Talent Scholarship (NRTS) award** - May 2014